

***CHALLENGE:***

***Improve the efficiency of a school's smart grid by redesigning the gymnasium on the logical model of the high school campus provided using sustainable materials and renewable technology then adding a localized power generation system as a campus energy source and component to the communities smart grid.***

Energy conservation and energy production are two of the larger issues facing our world as we head into the future. Students are our greatest hope and promise in solving our energy needs. As such, the SMART Competition is designed to expose high school students to power generation, energy monitoring, energy conservation, architecture and green design to lead them to create new solutions to better utilize our resources.

The SMART Competition is directed at high school students and will focus on building design, power and smart grid monitoring under various facility and campus loading conditions, neighborhood impact, monitoring the impact on the grid by adding different loading (charging cars, events, day-of-week, etc). The students will redesign the gymnasium and place the building onto an existing high school campus. The campus "site" chosen is adjacent to a river, will have a light rail train station to serve the campus and also a nearby small regional airport. The location was selected to enable the students the opportunity of incorporating different power generation systems (solar, water, biomass, buried plates, etc) and monitor the impact of different human-driven loads on the energy grid using smart dashboards. Incorporating the light rail station and commuter parking lot will provide an engineering design opportunity as a power generating facility and electric vehicle charging location. Geospatial information about the site and building information management specifications will provide the operating details for the various campus facilities.

The students will use Bentley Micro Station CAD (Computer Assisted Drawing) software with GIS (Geospatial Information System) features and energy analysis software tools to conduct the design and analysis requirements. The primary package the students will use for the energy audit requirements is the new AECO Sim (Architecture, Engineering Construction and Operation) software.

The students will tie the school campus to the community and electrical grid using Bentley PowerMap V8i. This will provide the GIS and CAD model for required Utilities and transportation infrastructure as it interacts with the community and outside world. The students will use the AECOsim Energy Simulator to monitor the electrical requirements of the campus on a weekly/monthly basis to establish the energy use baseline. This application will then be used to modify the building, change the materials (roof, walls, windows, doors, lighting, HVAC systems, etc) and landscaping to increase the campus energy efficiency.

There are four major components of analysis required:

1. Given the original campus configuration, run the energy analysis, based on provided loading factors and schedule, to determine existing energy use. This data will be used as a baseline for Component 2.
2. Modify the gymnasium using the Bentley software. The redesign can include changes to materials (roof, walls, doors, lighting, landscaping, orientation, etc). The purpose of the redesign is to improve the energy efficiency of the gymnasium. Rerun the energy analysis conducted in Component 1 to determine the impact of the redesign on the campus energy use and any changes to the school's micro-smart grid.
3. Add energy generating systems to the campus. Determine the impact of the energy generating systems on the campus and the surrounding neighborhood's smart grid.
4. Present actionable recommendation(s) to school district/school leadership that will improve the energy use or decrease reliance on externally provided power by their school.

Project deliverables include a computer generated animation of a fly-around of their campus and gymnasium, a research report based on the challenge of the Smart Grid and a team presentation. The students will also provide actionable suggestions to school officials that will impact power use, power generation or the application of applicable sustainable technologies for their school to utilize immediately.

The competition is designed to provide a real-world application of technology to enable students to address a critical environmental and energy challenge. In addition to the academic elements of the competition, the program will facilitate the development of workforce and life skills including computer analysis and software design, verbal and written communication, research, teamwork and problem solving.

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